

Work It

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**Making at home
workouts more
enjoyable!**

Application Area

Problem: Workouts at home lack variety.

Our solution:

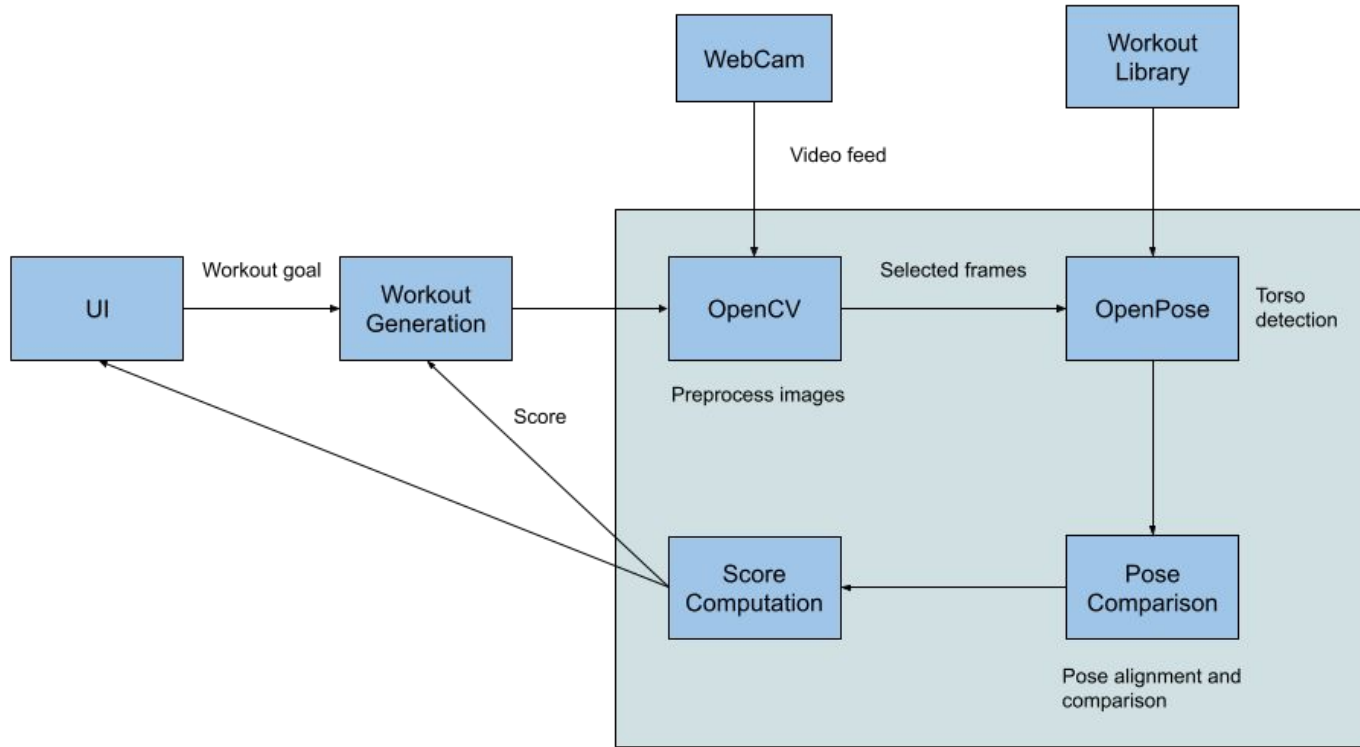
- Customized workouts
- Interactive scoring
- Progress tracking
- Increased exercises and repetitions over time

Solution Approach

(3 main goals)

1. Generate user specific workouts to cater to their fitness level
2. Use Tensorflow OpenPose to analyze body position of the model and the user
3. Give the user a score for their workout

System Specification



Jetson TX2

System Specification - UI

20 push ups

Nxt: 15 sec rest



15 sec rest

Nxt: 20 squats

A circular timer with an orange border and a black center. The timer shows 00:14 in white text. The timer is partially filled with orange, indicating the elapsed time.

00:14

Implementation Plan

Downloading



Buying



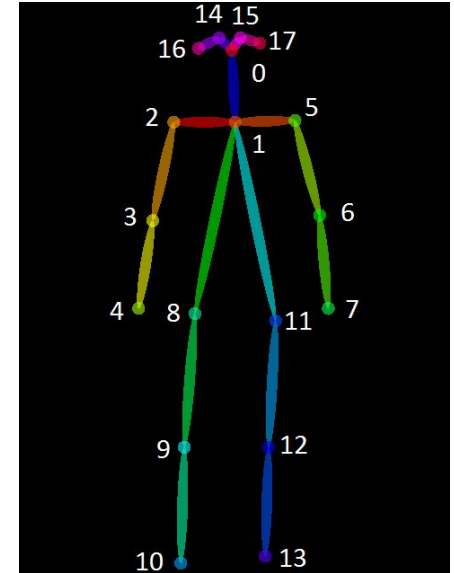
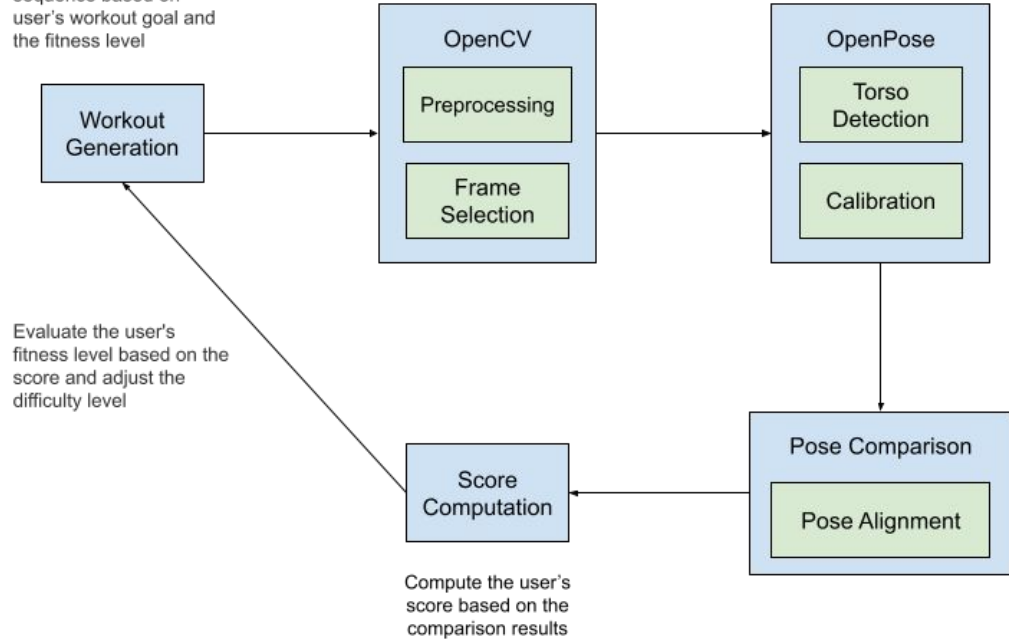
Implementing

- UI
- Workout construction algorithm
- Pose comparison
- Score computation



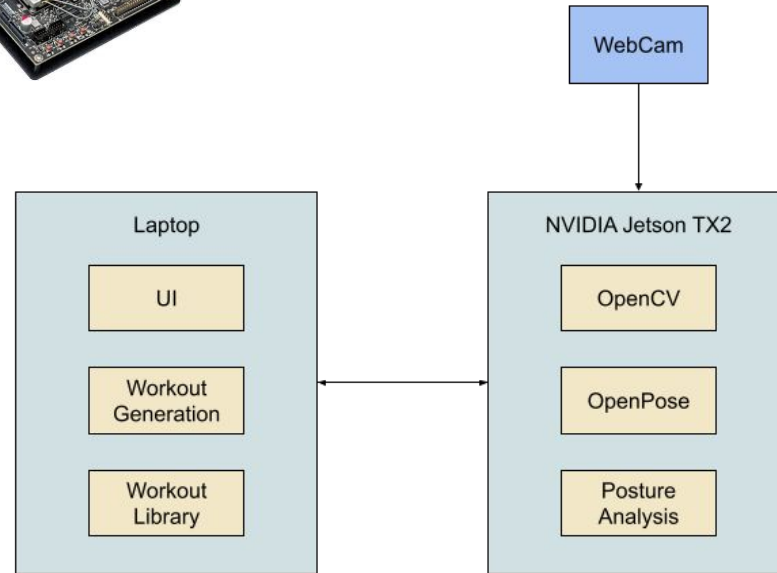
Software

Generate workout sequence based on user's workout goal and the fitness level



Hardware component (board)

Technical Specifications	
AI Performance	1.33 TFLOPS
GPU	NVIDIA Pascal™ architecture with 256 NVIDIA CUDA cores 1.3 TFLOPS (FP16)
CPU	Dual-core NVIDIA Denver 2 64-bit CPU and quad-core Arm® Cortex®-A57 MPCore processor complex
Memory	8 GB 128-bit LPDDR4 59.7 GB/s
Power	7.5W 15W
PCIe	1 x4 + 1 x1 OR 2 x1 + 1 x2 PCIe Gen 2, total 50GT/s
CSI Camera	Up to 6 cameras (12 via virtual channels) 12 lanes MIPI CSI-2 (3x4 or 6x2), D-PHY 1.2 (up to 30 Gbps)
Video Encode	1x 4K60 3x 4K30 4x 1080p60 8x 1080p30 (H.265) 1x 4K60 3x 4K30 7x 1080p60 14x 1080p30 (H.264)
Video Decode	2x 4K60 4x 4K30 7x 1080p60 14x 1080p30 (H.265 & H.264)
Display	2 multi-mode DP 1.2/eDP 1.4/HDMI 2.0 2 x4 DSI (1.5Gbps/lane)
Networking	Wi-Fi onboard 10/100/1000 BASE-T Ethernet
Mechanical	87 mm x 50 mm 400-pin connector Thermal Transfer Plate (TTP)



Metrics

Requirements	Testing	Metrics
Hardware Performance	Time how long it takes to analyze sets of images	< 1 min time limit
OpenPose Detection	Analyze runtime and accuracy for different image sizes/poses	90% accuracy
Pose Alignment	Analyze comparison results over different body types	90% accuracy
Pose Comparison	Test with similar poses/workout exercises	90% accuracy
Score Computation	Analyze the scores over different levels of completion	Score should reflect user's completion and accuracy

OpenPose Testing

Model	Avg Runtime(s)	Accuracy
CMU	1.14478	86%
Mobilenet_thin	0.23142	42%
Mobilenet_v2_large	0.23196	60%
Mobilenet_v2_small	0.16870	36%

Number of images = 50, Resize = 432x368



CMU

Mobilenet_thin

Risk Factors & Mitigation

- High latency
- Unable to track key points
- Different body types
- Score not reflecting performance

Workout	Avg Runtime(s)	Accuracy
Elbow to Knee	1.08485	70%
Rotating T Plank	1.08589	100%
Russian Twist	1.09047	90%
Side Lunges	1.09385	100%
Standing Extension	1.09028	90%

Model = CMU, Number of images = 10 per workout, Resize = 432x368

	Full Repetitions	Partial Repetitions (50% of expected amount)
Good Form (‘User video’ is a similar YouTube clip of same exercise)	Expecting near 100% accuracy between ‘demo’ and ‘user’	Expecting near 50% accuracy between ‘demo’ and ‘user’
Poor Form (Ex: pushups that only go down to 45° arm bend that should be 90°)	Expecting near 50% accuracy between ‘demo’ and ‘user’	Expecting between 0-25% accuracy between ‘demo’ and ‘user’

